

## Computing Hardware Platforms

# Advancing the Next Generation of Computing

Imagine a world where even mobile computers and handhelds are always on, always Web-connected 24 hours a day. A world where any change you make, like a meeting time in your calendar, is immediately reflected in all your computing devices no matter how far you are from some of them. A world where getting to your files or other data doesn't depend on the device it is stored on or the one you're using. A world where computing devices recognize you and respond to your presence, rather than you having to log on. A world where computers are as easy to use as toasters and reliable as clothes dryers. Intel Labs are accelerating the development of the technologies and specifications that can make these and other new uses of computing a reality. We're doing R&D on the entire range of computing devices — from servers and desktop PCs to mobile computers and handhelds. And we're helping usher in the convergence of the cellular phone and handheld computer. The history of the computer has just begun.

### Improving Connections In and Around the Computer

Our labs pioneer and champion new inter-connect technologies. We helped promote the industry adoption of open connectivity standards such as PCI, USB\*, AGP, and Universal Plug and Play\*. To make our "always connected" vision of the world a reality, we're working with industry groups developing wireless solutions for continuous Internet connections and device-to-device exchanges. Inside the computer, we're currently working on 3GIO, the third generation I/O architecture. This new architecture is intended to replace PCI, increasing the bandwidth between the processor and devices on the motherboard for substantial improvements in performance. We've also introduced the specifications for USB 2.0 and integrated it into our chipsets. This will provide peripheral connections with 40 times the performance of current USB technology.

In server technology, we're continuing our development of InfiniBand\* Architecture, a new solution forming a central network of connections between servers and remote networking and storage devices. With easier connectivity, reduced latency, improved bandwidth and enhanced interoperability, InfiniBand Architecture increases the performance, reliability and scalability of Intel-based servers to meet the growth needs of e-Business data centers, service providers and server farms.

### New Power Management Technologies

One of the biggest issues raised by today's proliferation of computers is the electrical power required to run them. In response, we're developing new power management techniques. These include everything from "instantly available PCs" with sleep states that consume less power than a night light,

to super efficient mobile computers with a battery life of 30 hours. As wireless technologies make it possible to stay connected all the time (and people will want to be), longer battery life will become increasingly important in mobile computers. So we're looking to take advantage of the 0.13-micron silicon manufacturing technology which allows microprocessors to run faster and consume less power. We're using enhanced Intel® SpeedStep™ technology which allows the dynamic adjustment of voltage and frequency, and the automatic adjustment between a maximum performance and a battery-optimized mode dynamically on the system. We're also looking at ways to reduce power consumption in other parts of the subsystem, such as the LCD panel, the biggest power consumer inside a mobile computer. We're looking at technologies that save power by dynamically adjusting the intensity level of the screen based on the ambient light inside a room.

### Form Factors and Thermal Management

As the number of multiple-computer homes increases, so does the demand for more compact desktop PCs. The expectation is that by 2005, 50 percent of the volume will be small form factor. In the labs we're developing new form factors such as the FlexATX specification. It reduces motherboard size by as much as 25%, enabling manufacturers to design smaller, less expensive PCs. Wireless technologies enabling online any time, anywhere capabilities will also drive greater interest in mobile form factors. We're working on technologies that will allow us to deliver not only mobile products optimized for full size and thin-and-light notebooks, but products that are optimized for the smaller systems, the three- to four-pound mini-notebook systems, the sub three-pound systems, and emerging form factors. For servers, we're developing

new scalable form factors for e-business, as well as advanced technologies inside and outside the box for increasing reliability, availability, serviceability, usability and manageability. In the area of thermal management, we're researching everything from new cooling technologies for microprocessors to strategies for thermal management in data centers housing hundreds of servers.

### Developing New Architectures

Some of our latest work in architectures involves speeding up the convergence of cell phones and handheld computing devices with Intel® Personal Internet Client Architecture (Intel® PCA), a system-level architecture consisting of interchangeable hardware and software building blocks that enable companies to offer a wide range of enhanced wireless devices and applications across standards, generations and geographies much quicker than today's phones. In servers, our Virtual Interface (VI) Architecture Initiative is helping develop common interfaces used to communicate within a cluster of servers or workstations, enabling levels of extensive data warehousing previously reserved for a dedicated mainframe.

### About Intel Labs

Intel Labs are the R&D arm of Intel. We have over 7,000 scientists and technologists in more than 75 labs in nearly a dozen countries worldwide. Our decentralized structure allows us to tackle a broad range of research projects. The labs are closely aligned with Intel's business units and focus on R&D for technologies and products that specifically address the needs of our customers.

### Designing the Future

Find out more about Intel Labs by visiting [www.intel.com/labs](http://www.intel.com/labs). The digital world of tomorrow is in our labs today.



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